

Application Serial No.: 10/521,335
Amendment and Response to October 17, 2006 Final Office Action

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

1-22. (Previously cancelled)

23. (Previously presented) A surface profiling apparatus (10, 60, 80, 102, 120) comprising:

an optical waveguide including a plurality of sensor sections, each sensor section comprising a respective optical waveguide grating curvature sensing device, each optical waveguide grating curvature sensing device comprising at least one long period grating (12, 14, 16); and

optical interrogation means operable to interrogate the optical waveguide grating curvature sensing devices to determine the curvature experienced by each device, the optical interrogation means comprising:

an optical source optically coupled to one, input, end (18a) of the respective optical waveguide and being operable to generate a narrow spectral bandwidth optical signal at a wavelength within the spectral range of an optical waveguide grating curvature sensing device to be interrogated, the optical signal being wavelength-modulated at a modulation frequency; and

optical detection means optically coupled to the other, output, end (18b) of the optical waveguide and being operable to measure the amplitude of a detected optical signal at least one harmonic of the modulation frequency in order to detect changes in the spectral transmission profile of the optical waveguide grating curvature sensing device being interrogated and to thereby determine the curvature experienced by the optical waveguide grating curvature sensing device;

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whereby the sensor sections are couplable to a surface to be profiled, and a profile of said surface is constructed from the curvatures sensed by the optical waveguide grating curvature sensing devices.

24. (Previously presented) The apparatus of claim 23, wherein the optical waveguide is an optical fibre (18) such as a silica-glass optical fibre or a polymer optical fibre, the optical fibre (18) comprising a core, an inner cladding layer surrounding the core, and at least a first outer cladding layer surrounding the inner cladding layer, the refractive index of the inner cladding layer being less than the refractive index of the core, and the refractive index of the first outer cladding layer being less than the refractive index of the inner cladding layer.

25. (Previously presented) The apparatus of claim 24, wherein the optical fibre (18) further comprises a second outer cladding layer surrounding the first outer cladding layer in order to isolate light propagating within a cladding mode of the inner cladding layer from a medium surrounding the second outer cladding layer, the refractive index of the second outer cladding layer being less than the refractive index of the first outer cladding layer.

26. (Previously presented) The apparatus of claim 23, wherein the at least one long period grating (12, 14, 16) comprises two long period gratings arranged to together define an in-line Mach-Zehnder interferometer.

27. (Previously presented) The apparatus of claim 23, further comprising coupling means for coupling the sensor sections to the surface to be profiled, the coupling means comprising a carrier member (40), and the sensor sections of the optical waveguide being fixed to or embedded within the carrier member (40).

28. (Previously presented) The apparatus of claim 27, wherein the coupling means comprises a plurality of carrier members (40) mounted on a support structure, one or more sensor sections being fixed to or embedded within each carrier member (40).

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29. (Previously presented) The apparatus of claim 27, wherein the carrier member (40) is deformable and comprises a flexible skin fixed to a partially rigid, expandable skeleton structure.

30. (Previously presented) The apparatus of claim 28, wherein each carrier member (40) is deformable and comprises a flexible skin fixed to a partially rigid, expandable skeleton structure.

31. (Currently amended) The apparatus of claim [1] 23, wherein the optical interrogation means is at least one of a derivative spectroscopy and a synthetic heterodyne based optical interrogation means operable to detect changes in the spectral profile of an optical waveguide grating curvature sensing device.

32. (Currently amended) The apparatus of claim 31, wherein the optical detection means comprises:

a photodetector (26) optically coupled to the output end (18b) of the or each optical waveguide and a plurality, corresponding to the number of optical waveguide grating curvature sensing devices provided within the respective waveguide, of lock-in amplifiers (28, 30, 32) or synchronous detectors each operable to measure the amplitude of a detected optical signal at the modulation frequency associated with a particular optical waveguide grating curvature sensing device and a harmonic of the modulation frequency; and

data processing means connected to the [or each] photodetector (26), operable to calculate the ratio of the amplitudes and the arc tangent of the ratio of the amplitudes, to which the curvature experienced by the optical waveguide grating curvature sensing device under interrogation is linearly related.

33. (Previously presented) The apparatus of claim 27, further comprising a respiratory function monitoring apparatus (100) operable to utilize the surface profiling apparatus (10, 60, 80, 102, 120) for use on the rib cage or torso during respiratory movement.